Session 40

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Regional Ponds for Stormwater Reuse

Topic Description

The use of regional stormwater ponds has been enhanced with the results of research that indicates that the pond water is cleaner than some lake waters. 16 ponds were examined and compared to lake water in terms of cyanobacteria levels and toxins.

Speaker Biography

Marty Wanielista is the director of the Stormwater Management Academy, Professor of Engineering and Professor Emeritus at the University of Central Florida. He has been at UCF for over 36 years. He has a Civil Engineering degree from the University of Detroit, Masters from Manhattan College, and a PhD in Environmental Systems from Cornell. He has completed over 60 research projects in the areas of Hydrology and Stormwater, and is currently working on 12 projects for the Stormwater Management Academy. He has over 200 publications including 7 textbooks.

2006
DESIGN CONFERENCE

Designing For More Than Bridges and Roads

Regional Ponds for Stormwater Reuse

Presentation by Marty Wanielista
August 2nd 2006

Stormwater Management Academy
"Managed stormwater is good water."

UCF

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* Stormwater Management Academy
** Florida Department of Transportation

Acknowledgements

- Rick Renna, Florida Department of Transportation
- Eric Livingston, Florida Department of Environmental Protection
- Rick Baird, Orange County

Outline

- What and Why?
- Examples
- Water Quality Considerations
- Design Considerations
- Benefits
- Conclusions

What and Why?

WHAT? Stormwater from surface or groundwater sources used for non-potable purposes, like irrigation

WHY? (the top 5 reasons)

1. Used when roadway green areas need to be irrigated.
2. Can have a utility or LOS (be a profit center), thus some else takes on the maintenance.
3. To reduce mass discharges from regional areas, or meet TMDL standards and improve water quality.
4. Can not get a permit to draft more water from an existing source (groundwater or surface water).
5. Want to save valuable potable groundwater or increase the level of the aquifer.

Some examples follow:

Saint John's River 2005

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I-295 St Johns Crossing

Microcystis Bloom - I-295 (north view) over mid-channel St. Johns River - 08.19.05 - 2:43pm

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Caloosahatchee River
Southwest Florida Coast
October 15, 2005

Slide provided by
Eric Livingston, FDEP

So what can we do? Use Regional Pond! Some examples

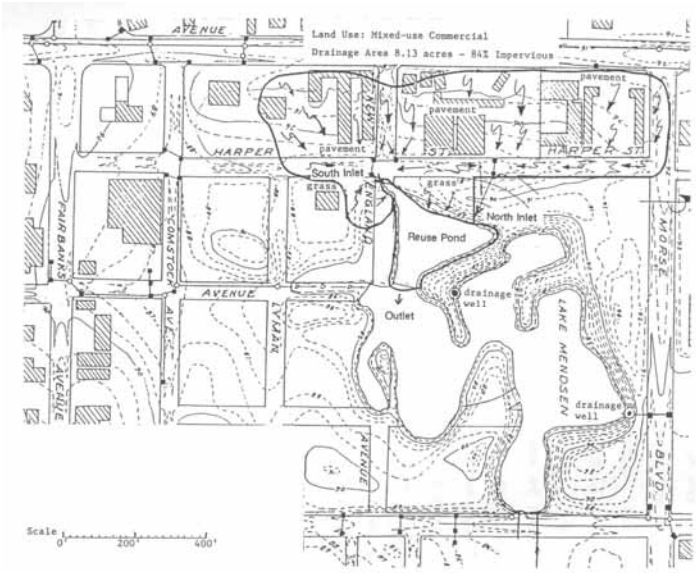


Figure 4-3. Watershed Detail

PRE-CONDITION NEGLECT

RESTORATION-IN-PROGRESS
WATERSHED AREA AND POND

SHORELINE BEFORE
REVEGETATION

SHORELINE AFTER
REVEGETATION

COLLECTS RUNOFF WATER

Regional Pond Serving roadway and commercial property

CONTROLS POLLUTION

AND REUSES THE WATER

Water reuse for irrigation of lawns
Community saved potable water as well as money.

South Bay Utilities Inc.

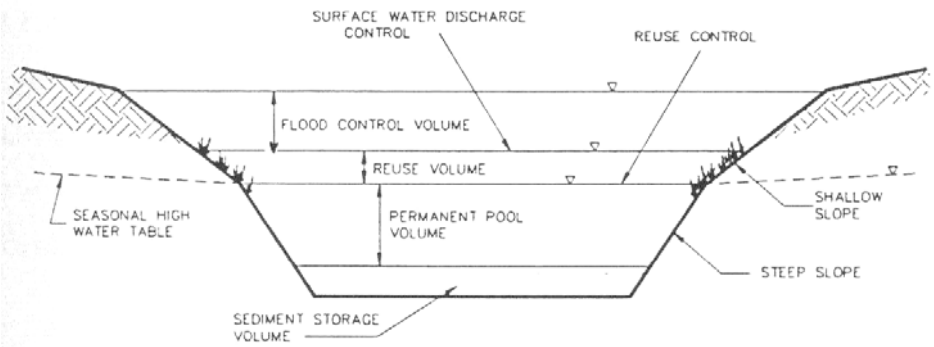
- Upscale residential irrigation demand
- No CUP
- No FPSC
- No FDEP

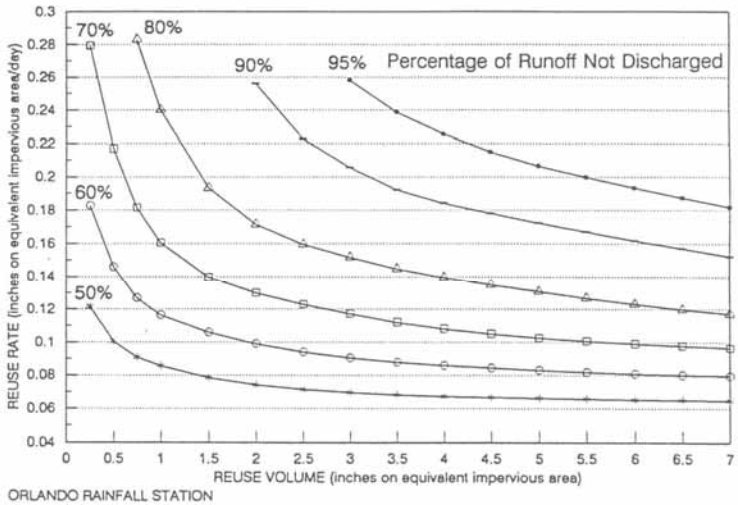
- 50¢/1,000 gallons not certified
- Shallow wells
- Customer agreements 900 homes - HOA
- Coastal / fragile resource

Dubstread Golf Course and I-4 Stomwater Management Plan

- Plan – Provide water on golf course to improve the play and image of the course.
- FDOT – We got the water for you.
- WIN WIN FDOT and a high school gets stormwater plans, citizens get a real golf course.
- All get stormwater treatment and saving of potable water that would otherwise be used for irrigation.
- And oh yes, Wekiva is protected.

District Signature Project





ORLANDO RAINFALL STATION
MAY 1974 - DEC. 1988
MEAN ANNUAL RAINFALL = 48.2 in

Water Quality Considerations

- Irrigation water must be clear of disease causing organisms that people may drink.
- Reminds me of a sign over a toilet. “don’t drink the water in the toilet” and the sign on a yard irrigation system… “don’t drink the water – reclaimed water.”
- Also by removing stormwater from discharging to a surface water, we help meet TMDL limitations.

Research Objectives

Determine the counts of Cyanobacteria

- Document if Cyanobacteria exists in stormwater ponds in the Central Florida area.

Determine the concentration of toxins

- Document if toxins associated with Cyanobacteria exist in the stormwater ponds and at what levels.

Research Objectives (continued)

Determine if filtration through a natural soil media affects the counts and concentration

- Document the counts and concentration after filtration through poorly-graded A-3 sandy soil.

Determine if stormwater ponds can be a safe source for irrigation

- Document if the counts and concentration of Toxins in stormwater ponds are a public health risk.

14 Roadway Ponds

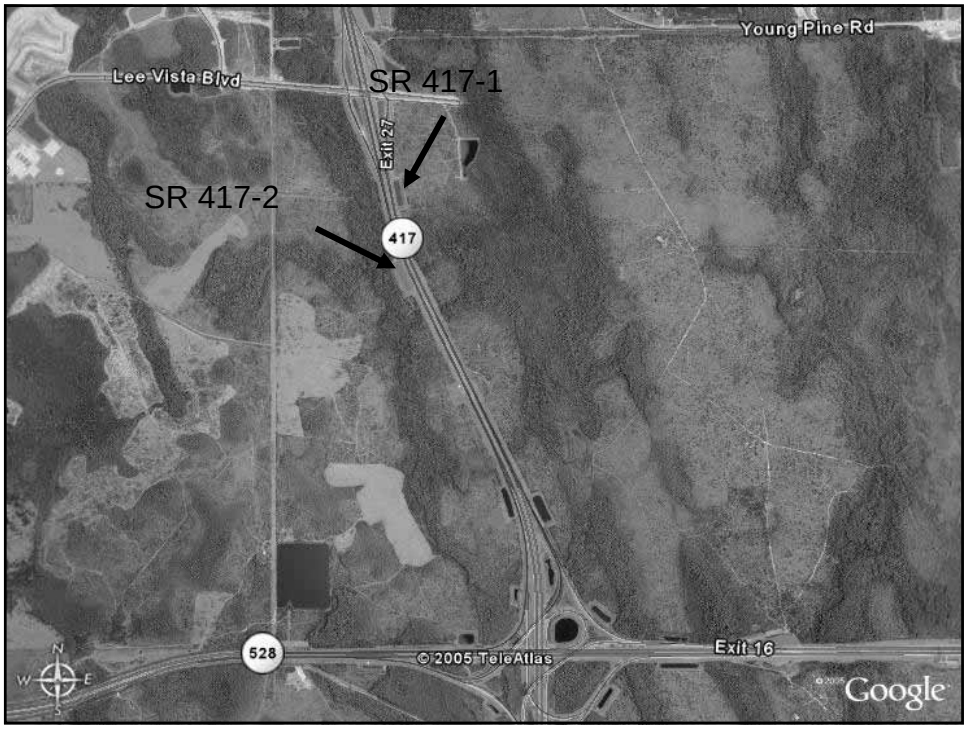
- Geographic area (Central Florida)
  - Orange and Seminole Counties
- Stormwater ponds
  - All take drainage from a roadway
  - 12 of 15 FDOT design.
  - 14 ponds sampled, one had access problems

	Name	Pond Area (acre)	Estimated Watershed Area*** (acre)	Watershed	Approximate Average Depth* (ft)	I Mea
1	Lake Condel	2.7	135	Residential	10	
2	Terrier Pond	4.6	230	Residential	14	
3	UCF South Irrigation Pond off Campus Road	4.4	220	Roads and Parking	6	
4	UCF Pegasus Pond off Campus Road	0.6	30	Roads and Parking	6	
5	Lake Patrick	9.4	470	Roads and Parking	11	
6	SR 417-1, NB at Lee Vista Boulevard Exit	1.7	85	4 Lane Divided	8	
7	SR 417-2, SB 0.5 miles south of Lee Vista Boulevard	1.8	90	4 Lane Divided	8	
8	SR 417-3, NB at SR 528 (Beeline) exit	3.5	175	4 Lane Divided	8	
9	SR 417-4, NB 2 miles north of Narcoossee Road	3.3	165	4 Lane Divided	8	
10	SR 417-5, NB 1 mile north of Narcoossee Road	2.0	100	4 Lane Divided	8	
11	University Boulevard and Hall Road	0.9	45	6 Lane Curbed	4	
12	University Boulevard and SR 417, NW corner	4.6	230	6 Lane Curbed	6	
13	University Boulevard and SR 417, SW corner	0.6	30	6 Lane Curbed	5	
14	Horatio Avenue and Via Tuscany No. 1	1.1	55	4 Lane Curbed	4	
15	Horatio Avenue and Via Tuscany No. 2	0.2	10	4 Lane Curbed	3	

* Average Depth
** Surface Area Multiplied by Average Depth
*** Based on 2% of the Watershed used for Pond Area

S.R. 417 Stormwater Ponds – Greenway in Orange County

- S.R. 417-1
  - NB at Lee Vista Boulevard Exit
  - Approximately 1.7 acres
  - Average Depth 8 feet
  - Approximate Volume 14 acre-ft
  - Estimated watershed area of 85 acres



S.R. 417 Stormwater Ponds – Greenway in Orange County

- S.R. 417-2
  - SB 0.5 miles south of Lee Vista Boulevard
  - Approximately 1.8 acres
  - Average Depth 8 feet
  - Approximate Volume 14 acre-ft
  - Estimated watershed area of 90 acres

S.R. 417-4

- Northwest corner

- View of north shoreline

Urban Roadway Stormwater Ponds

- Horatio Avenue and Via Tuscany No. 1
  - NW of intersection
  - Approximately 1.1 acres
  - Average Depth 4 feet
  - Approximate Volume 4.4 acre-ft
  - Estimated watershed area of 55 acres

Sampling Results

- 2 Sampling periods April and August 2005
- Documented the count and toxin concentrations.
- Comparison between pond and lake water counts.
- Comparisons between pond and filtrate water counts and toxins.
- Comparison with count to pond volumes.

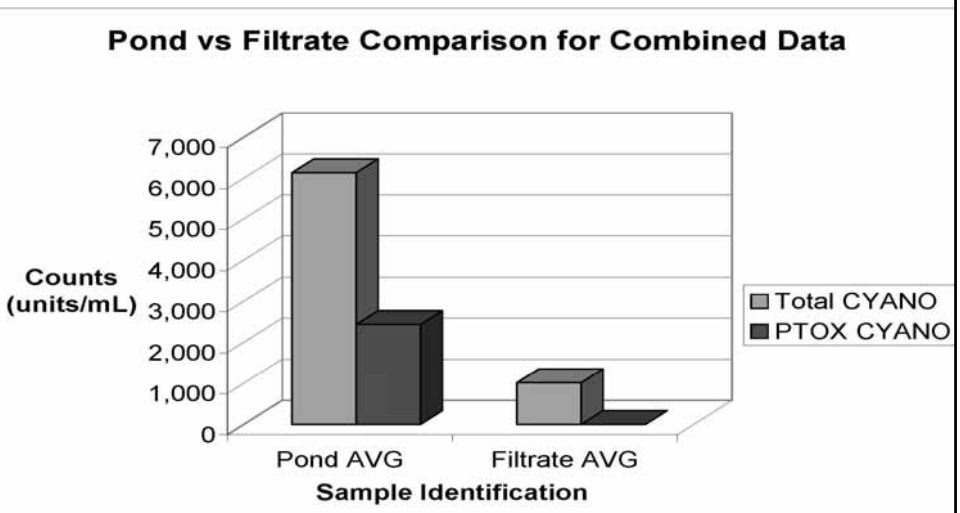
CYANOBACTERIA POPULATIONS IN SEVEN CENTRAL FLORIDA LAKES

Sample Description	Sampling Date	Total CYANO Units/mL	PTOX CYANO Units/mL
Lake Apopka	Year 1	1,361,860	13,550
	Year 2	1,136,098	1,864
Lake Beauclair	Year 1	650,370	154,190
	Year 2	449,210	69,420
Lake Dora	Year 1	581,110	144,590
	Year 2	500,196	129,510
Lake Eustis	Year 1	<285,000	
	Year 2	<285,000	40,520
Lake Griffin	Year 1	<285,000	
	Year 2	<285,000	
Lake Harris	Year 1	235,570	
	Year 2	116,700	41,990
Lake Yale	Year 1	<285,000	
	Year 2	<285,000	

from:
Chapman et al, June 2004, "Cyanobacteria Populations in Seven Central Florida Lakes
15th Annual Conference of the Florida Lake Management Society, Tampa Florida

Comparisons to Lakes

- 3 order of magnitude less in ponds versus lakes. Millions versus thousands.
- Filtrate even less.



Significant Differences (99 and 99%) for Combined Data

Summary

- Sampled fourteen (14) stormwater ponds that had detectable Cyanobacteria
  - Total, PTOX and Microcystin Toxins encountered
  - Variety of locations, sizes and watersheds
    - Residential, UCF campus, industrial site, major expressway and urban roads
- Geographically restricted to Central Florida
  - Orange and Seminole counties

Conclusions

- Cyanobacteria does exist in stormwater ponds evaluated in this study.
- Counts in the stormwater ponds are much lower than those encountered in large lakes and rivers.

Conclusions continued

- Filtration through the poorly-graded A-3 sandy soil does reduce the counts of TOTAL and PTOX.
- There was no correlation between pond volume and Cyanobacteria counts or toxin concentrations.
- Filtrate waters had a Microcystin concentration less than the WHO 1 ug/L standard for drinking water, and the pond water exceeded the standard 7 % of the time, or in 2 of 28 stormwater ponds sampled.

Design Considerations

1. Users and use characteristics
   a) Is there a need? Wetland hydration, lawn irrigation, agricultural needs, etc
   b) Non metered vs. meter
   c) Pressure
   d) Volume and rate
   e) Additional treatment (at point of use)

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Design Considerations

2. Source

   a) Is there land available for a regional site, or a surficial aquifer?

   b) Collection system under-drain, horizontal drainage wells, shallow wells, deep wells, ponds, canals and reclaimed water (power plant, wastewater, etc.)

   c) Volume and rate as a safe yield.

   d) Water quality, chlorides, corrosive, calcium and magnesium hardness, pKs, metals (iron etc.) and odors (H_2S etc.), bacteria and virus content.

Design Considerations

3. Regulatory Thresholds
   a) Water use permit > 4”
   b) 100,000 gallons/day (may be 50,000 in springshed areas).
   c) FDEP – if mixed with reclaimed H_20
   d) Right of way utilization easements

Design Considerations

4. Size of Pond and Performance
   a) Mass Balance IN-OUT=Storage Change
   b) Consider all inputs and outputs
   c) Consider also the availability of alternative supplies to increase reliability.
   d) Simulations

Design Considerations

5. Others
   a) Electrical Power Feeds
   b) Interconnection valves and meters, blow offs, grit removal
   c) Ground soil conditions to include porosity, type and others
   d) More, but site specific

Benefits

1. Very cost effective, home owners pay less, $.12-.50 versus $2-5, and a Utility can make money.
2. Reduces pollution (TMDLs)
3. Preserve potable water sources
4. Maintains hydrologic balance and Uses natural cleansing processes

Benefits

5. Lowest energy requirement
6. Local sources first, Chapter 40 FAC
7. Use of lowest quality water for lowest quality need
8. Can be used for multiple reasons
9. Others

Conclusions

1. An alternative water source
2. Least economic burden on a community
3. Helps meet TMDL limitations
4. Proven Technology
5. Benefits

The best water resources option
that you have not considered

H2O4U

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Designing For More Than Bridges and Roads

Thank you,
Questions?

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"Managed stormwater is good water."